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(54) **NAVIGATION APPARATUS AND METHOD.**

(57) A navigation apparatus and method designed chiefly for the drivers and also for pedestrians when no such instrument as a distance sensor or a bearing sensor is used. Upon receipt of data related to the passage along which one is now traveling, such as signals from transmitters installed along the passage, electromagnetic waves from an artificial satellite, or based on the distance sensor and bearing sensor, or upon receipt of information input by the user, the apparatus displays what would happen if one proceeds the passage without turning right or left or what would happen if one proceeds a predetermined lane. When a target is set, the apparatus displays both the target and the lane to travel, and further displays the passage leading to the target as well as a proper and suitable passage that leads from a major passage to the target. The data of passage are retrieved by attaching group code and common code to the links.

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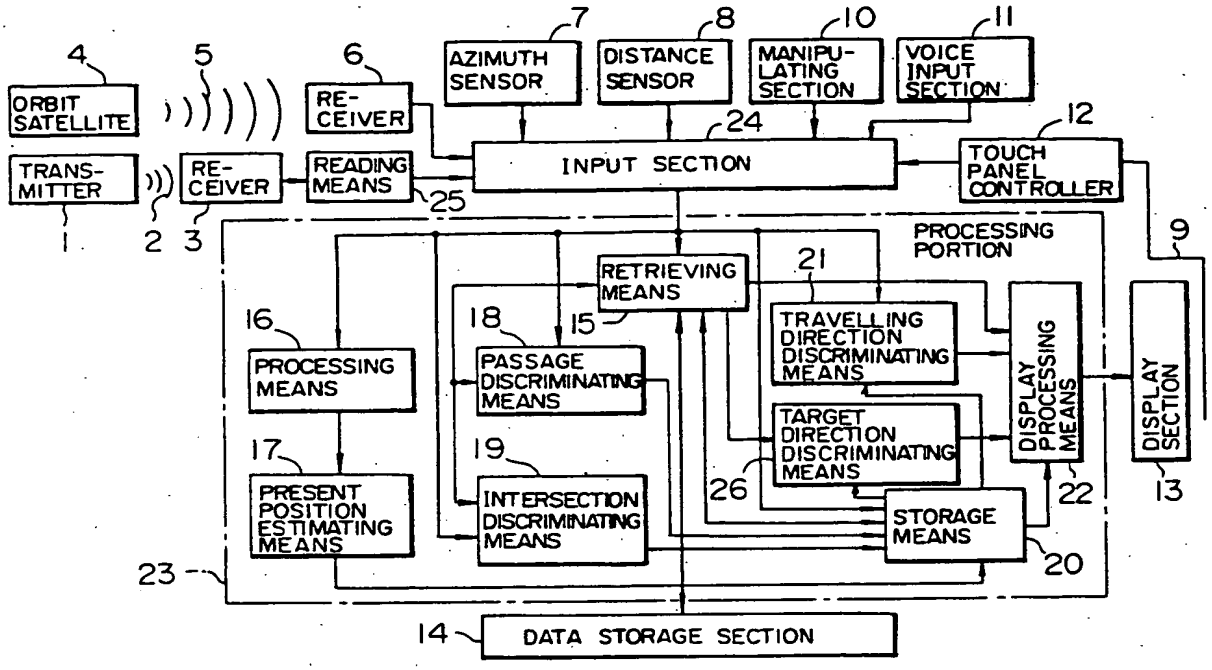
FIG. 1


ORBIT SATELLITE
TRANS-MITTER
RE-CEIVER
RE-CEIVER
READING MEANS
AZIMUTH SENSOR
DISTANCE SENSOR
MANIPU-LATING SECTION
VOICE INPUT SECTION
INPUT SECTION
TOUCH PANEL CONTROLLER
PROCESSING PORTION
RETRIEVING MEANS
PROCESSING MEANS
PASSAGE DISCRIMINATING MEANS
TRAVELLING DIRECTION DISCRIMINATING MEANS
TARGET DIRECTION DISCRIMINATING MEANS
DISPLAY PROCESSING MEANS
DISPLAY SECTION
PRESENT POSITION ESTIMATING MEANS
INTERSECTION DISCRIMINATING MEANS
STORAGE MEANS
DATA STORAGE SECTION
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Technical Field

The present invention relates to a navigation system which is mainly used by a driver of an automobile and a method therefor.

Background Art

A conventional navigation system having a storage device, a processing device, an input device, a display device, sensors and the like and a navigation method to be executed in the system may be classified into the following two types on the basis of the contents displayed on the display device.

One of the two types is a map display system which is arranged in such a manner that a map is displayed on the screen of the display device and a travelling locus, a present position, a moving direction, a target, a target direction, a instructed course or the like are indicated in the map. Another one is an arrow display system which is arranged in such a manner that no map is displayed but arrows respectively showing the target direction and the course instruction at each intersection are indicated.

The map display system and the arrow display system respectively have encountered the following problems:

According to the map display system, a driver must look the displayed map while driving a vehicle. Therefore, the driver must pay attention to many factors and thereby the driver will be exhausted, causing a load to be applied to the driver. Furthermore, a risk will arise as the case may be. Therefore, in the conventional map display system, the display device has been disposed in a lower position so that the driver cannot look it during driving, or only main roads are indicated during driving. However, these devices could not satisfactorily overcome the problems and thereby a risk in terms of the traffic safety remains. Because of the risk, the European countries have had a denial view on the map display system and therefor they have not employed the map display system.

The arrow display system encounters the following two typical problems: In a case where the target direction is shown by an arrow as one of the display modes of the display device, the driver psychologically tends to earlier turns to the right or left in accordance with the shown arrow, causing a problem to arise, for example, the vehicle strays in a residential area. Furthermore, in a case where the course is instructed at an intersection as another display mode, timing at which traffic information collected in a real time is indicated and acceptability for the drivers, which becomes a serious problem for the aged and female drivers, remain as unsolved problems, because there is a course instruction as the assumption.

According to a basic system design concept used for developing the conventional navigation system, the most important factor for the navigation system lies in that the present position of the user's vehicle, which is moving, is accurately recognized in a map which has been previously prepared. This system design concept is similarly applied to both the map display system and the arrow display system.

However, there are other problems different from the above-mentioned problem as explained hereinafter.

That is, since the vehicle such as an automobile moves at considerably high speed, it is not so practical for the driver even if the driver recognizes the present position of the vehicle as a point of low accuracy on the map displayed on the display device. That is, it is rather acceptable for the driver who is driving the vehicle, in the aspects of the speed sensibility and the sense about the positional relationship and the directional relationship with respect to his target, that the driver recognizes the state of the vehicle's movement as a line while making the positional relationship with respect to the target clear than recognizing the present position indicated as a point, on the screen of the display device. It is easier and more natural for the driver to recognize the state of the vehicle's movement as the line than to recognize the state of the movement as the point. Furthermore, information about the state of the movement as the line is more valuable as available drive information. In addition, since the user's vehicle such as an automobile must move while being restricted by a road in a different manner from an airplane and a ship, it is more practical to recognize the road on which the user's vehicle is moving at this very moment while making the positional relationship with the target for the user's vehicle clear than obtaining the present position of the user's vehicle as a point.

Furthermore, if the present position of the user's vehicle is intended to be accurately obtained, the load of realizing the high accuracy becomes too heavy for the navigation system. As a result, the cost for manufacturing the navigation system cannot be reduced and thereby wide using of the navigation system will be interrupted. Therefore, the primary ideal of preventing the traffic snarl and realizing the safety traffic cannot be achieved.

It is very dangerous for the driver to drive his vehicle while actually looking for a road. Therefore, there has been a desire of a practical navigation system to be developed as a system of aiding the driver to easily reach the position of the target. According to the conventional navigation system arranged in accordance with the map display sys-

tem, the driver must look for the driving course set on the road map displayed on the display device. Therefore, the dangerous factor cannot be eliminated and thereby its practicality is insufficient.

Since the driver must pay attention to many things during driving the vehicle, the load of the driver must be reduced for the purpose of safely driving the vehicle. Therefore, it is preferable that a navigation system be arranged in such a manner that information necessary to select the course can be obtained at first sight.

According to the conventional navigation system arranged in accordance with a route guide system in which the driving course through which the vehicle reaches the target is indicated on the display device, an optimum driving course is set in accordance with the relationship between the start position and the target position at the time of start of driving. According to the above-described navigation system arranged in accordance with the route guide system, it is actually difficult to drive the vehicle while keeping the driving course in the actual road state even if the driving course is indicated on the display device. Furthermore, the degree of the danger can be increased due to stress given to the driver when the determined driving course is instructed for the driver.

However, if the instruction by means of indicating the driving course is not made but only the present position of the user's vehicle is indicated, the value of information is insufficient. It is more dangerous to look for the course in accordance with the present position shown on the road map displayed on the display device than to instruct the driving course.

It is important for the navigation system to, via the display device, show the drive information which is valuable to reach the target in a state in which the safety cannot be deteriorated. In particular, intense stress is given to the driver if the optimum driving course to reach the target is determined before the start of driving and the one fixed driving course is shown to the driver. In order to prevent the state in which the stress is given to the driver, it is preferable that the navigation system be constituted in such a manner that the driver is able to select a course to reach the target and the driver's determination about the selected course is given priority. As a result, the driver is able to drive the vehicle with composure.

Furthermore, the current background in which the aged and the female drivers increase must be taken into consideration. In addition, the mental state and recognition of the driver in a specific situation must be considered.

Therefore, it is insufficient for the display device to indicate the present position of the user's vehicle on the map. In addition, it is an excessive function to indicate the driving course on the map.

An object of the present invention is to provide a significantly practical navigation system and a method therefor capable of over-coming the above-described problems and meeting the above-described requirements by supplying required and minimum information to the driver.

Disclosure of the Invention

According to the present invention, in a navigation system and a method therefor, in which coordinates and various data items are stored, the required process is performed when inputting information and furthermore the indication as to the information is performed, the navigation system and the method therefor is arranged in such a manner that when information about a passage through which a moving object is moving at this very moment is supplied by means of any one or some of a receipt of a signal transmitted from a transmitter, a receipt of satellite electric waves, detections of a distance sensor and an azimuth sensor and an operation of a user, a line (hereinafter referred to as a "travelling line") representing the passage through which the moving object is moving at this very moment is, together with information about a target such as a target position, indicated on the screen of the display device.

As will be described below, the present invention has a plurality of embodiments so as to select a proper embodiment in accordance with the purpose and way of use of the present invention. According to these embodiments, a variety of configurations for variously generating the travelling line and states of indication mode on the screen of the display device are explained.

A preferred aspect of the present invention lies in a navigation system and a method therefor arranged in such a manner that transmitters are disposed in the passages and a signal to be transmitted from the transmitter is given data about the shape and the position of the passage in which the transmitter is disposed, whereby, when a main unit of the navigation system mounted on the moving object and having a signal receiving function receives the signal, a travelling line representing the passage through which the moving object is moving at this very moment is indicated on the display device. Furthermore, a configuration may be constituted in such a manner that a code is given to the signal to be transmitted from the transmitter, data about the shape and the position of the passage is stored in a data storage device of the main unit, data about the shape and the position of the passage which corresponds to the code read from the signal is retrieved from the data stored in the

storage device on the basis of the code read from the signal and the travelling line is indicated on the basis of the retrieved data.

A preferred aspect of the present invention lies in a navigation system and a method therefor arranged in such a manner that data about the shape and the position of a passage is stored in the data storage device, data corresponding to the passage through which the moving object is moving at this very moment is retrieved from data stored in the data storage device when information which can be recognized by a user when the user moves through the passage and with which the passage through which the moving object is moving at this very moment can be specified and the travelling line is indicated.

A preferred aspect of the invention lies in a navigation system and a method therefor arranged in such a manner that the present position is estimated on the basis of satellite electric waves, or a distance sensor and an azimuth sensor, a passage which is nearest to the estimated present position is discriminated, data about the shape and the position of the passage is retrieved from data stored in a data storage device and it is indicated as a travelling line. A configuration may be employed which is arranged in such a manner that a locus of a passage which can be considered that the moving object has passed through is obtained on the basis of the estimated present position, the passage through which the moving object has passed is discriminated on the basis of a result of a comparison made between the locus and the shape of the passage, data about the shape and the position of the passage which is positioned in front of the passage through which the moving object has passed and through which the moving object will pass through if it does not turn to the right/left is retrieved from data stored in the data storage device and it is indicated as a travelling line.

A preferred aspect of the present invention lies in a navigation system and a method therefor arranged in such a manner that it comprises a distance sensor and an azimuth sensor, the passages which intersects each passage are, together with the state of advancement into the intersection, stored, the distance between the intersections is stored, the distance from the initial movement position is detected by the distance sensor, the distance from the initial movement position to each intersection is obtained, the stored distance and said quantity of detection are subjected to a collation, the intersection which is passed at the time of the detection is estimated on the basis of the collation, the passage into which the moving object has been advanced is estimated on the basis of the detected state when the state of the advancement into the intersection is detected, data about the shape and the position of the passage into which the moving object has been advanced is retrieved from data stored in the data storage device and a travelling line representing the shape and the position of the passage is indicated on the display device. Another configuration may be employed in which the state of advancement of the user into the intersection is supplied in place of the detection of the azimuth performed by the azimuth sensor to estimate the passage into which the user has advanced, data about the shape and the position of the passage into which the user has advanced is retrieved from data stored in the data storage device and the passage is indicated as the travelling line.

As described above, according to the present invention, generating and indicating of the travelling line can be realized by a variety of configurations. In the configuration according to the present invention, a passage to the end point of the passage which can be selected if the moving object moves without performing turning to the right/left or along a course in which the driving is regulated is, as information necessary and sufficient for a driver or the like to select a course and in the form of information called the "travelling line", indicated on the screen of the display device. The concept of the display information called the "travelling line" has not been disclosed according to the conventional navigation systems.

The navigation system and the method therefor according to the present invention treat the target for the moving object to reach as follows:

The configuration is constituted in such a manner that the coordinate position of the target is supplied so that codes about name of the target, the number given to the target and the name are supplied to retrieve data about the target on the basis of the supplied information and information about the target such as the target position is indicated on the screen of the display device.

In a case where information supplied to the main unit or information supplied for the purpose of retrieving data about the passage to indicate the travelling line includes information about the present position, an area to which both the present position and the target position belongs is retrieved and the area is displayed on the display screen and as well as the target position and the travelling line on which the present position or an equivalent position in place of the present position are positioned are indicated on the display screen. The supplied information including information about the present position is examplified by a case in which a signal transmitted from the transmitter includes information about the position at which the transmitter is disposed, a case in which inputting is

performed in accordance with the name of the intersection, the name of a place, the lot number and the name of the roadside facility, a case in which a specific coordinate position is supplied, a case in which the code numbers which correspond to elements showing the above-described positions substantially show the equivalent place in place of the present position and a case in which information about the estimated present position is supplied.

As described above, the target and the travelling line representing the passage through which the moving object is moving at this very moment are always indicated on one display screen. Therefore, the user is, at first sight of the display screen, able to determine the selection of the course through which the user is able to reach the target on the basis of the relationship with the actual driving situation.

That is, when the driver or the like, who is a user, looks the travelling line indicated on the display screen, the user is able to quickly, easily, extemporaneously and at free will determine to go straight along the passage through which the user's vehicles is moving at this very moment, or turn to the right or left into another passage in accordance with the positional relationship with the target.

The travelling line serving as information with which the moving object is able to reach the target is superior information with which the determination is made to conventional information used in the conventional navigation technology such as the locus, the present position, the target direction and the moving direction. Furthermore, the configuration according to the present invention is arranged in a manner different from the configuration in which a previously set optimum driving course is instructed but the same is arranged in such a manner that the determination made by a driver or the like is given priority. Therefore, the load and danger of the driver can be eliminated from the psychological viewpoint and a significantly preferable effect can be obtained in terms of the traffic safety.

In addition, information, that is, the present position of the moving object is not obtained but only the line representing the passage through which the moving object is moving at this very moment must be grasped. Therefore, the restriction involved in the conventional system in which the driving course and the moving object must be continuously aligned with each other on the road map displayed on the display screen can be eliminated. As a result, the load in terms of the accuracy applied to the navigation system can be reduced.

If information for specifying the passage is once supplied, in accordance with the most simple configuration, the travelling line can be generated and indicated. Therefore, the ensuing necessity of estimating the present position by means of the navigation system can be eliminated to make it serve as the navigation system.

In each mode of the present invention, the configuration is constituted in such a manner that the present position of the user's vehicle or an equivalent place in place of the present position, an intersection line representing the passage which intersects the passage through which the user's vehicles is moving at this very moment, the intersection of the travelling line and the intersection line, the moving direction and the locus are, as secondary determination information, indicated. As a result, a variety of requests made in each mode can be met while making the indication of the travelling line to be the basic function.

Furthermore, a preferred aspect of the present invention can be constituted in such a manner that data about the shape and the position of the passage at which the target confronts is stored in the data storage device, data about the target position and data about the passage which confronts the target are retrieved when a target is set, the target position is indicated on the display device and as well as a line representing the passage which confronts the target is indicated on the display device. Another configuration example may be arranged in such a manner that data about the shape and the position of a passage which constitutes a course through which the moving object is able to properly correctly reach the target from a main passage positioned near the target is, together with data about the shape and the position of the passage at which the target confronts, stored in the data storage device. Thus, when a target is set, data about the target position and data about the shape and the position of the passage at which the target confronts are retrieved and as well as data about the shape and the position of the passage which constitutes the course through which the moving object is able to reach the target is retrieved and the target position and the line representing the passage at which the target confront are indicated on the display device and as well as the line representing the passage which constitutes the course through which the moving object is able to reach the target is indicated on the display device.

As a result of the thus-made configuration, the passage and the travelling line with which an access to the target can be made are clearly shown on the display screen. Furthermore, by arranging the configuration in such a manner that the passage which is able to be adapted to the directional regulation is formed into data and the above-described passage is indicated or the regulation is clearly indicated, the moving object is significantly

easily able to reach the target.

Furthermore, the present invention can be constituted in such a manner that the target and the travelling line are not indicated on one display screen. According to this example of display, the configuration is constituted in such a manner that the target direction is retrieved while making the central point or arbitrary points of an area displayed on the display screen in which the travelling line is indicated to be a start point and the target direction is, together with the travelling line, indicated by an arrow or the like.

As a result of the thus-arranged configuration, in a case of a mode of the present invention in which the present position and an equivalent position in place of the present position is not used as the assumption, for example, in a case where the travelling line is indicated when a user supplies the name or the code of the passage as information, in a case where it is difficult to indicate the target and the travelling line in one area due to the restriction caused from date, or in a case where the present position cannot be detected due to some trouble, the system according to this mode is able to serve as a supplementary function to aid the driver or the like to select the course. Furthermore, since the travelling line is indicated, the arrow representing the target direction does not trouble the user. Therefore, this mode of the present invention is able to serve as a satisfactory effective navigation system.

Furthermore, according to the mode of the present invention in which the distance sensor and the azimuth sensor are not required, the navigation system and the method therefor according to the present invention can be utilized as a portable apparatus adaptable to a pedestrian. Also according to this mode, the travelling line and the target are indicated in a manner different from the conventional configuration in which the map is displayed. Therefore, the user is able to recognize the direction of movement to reach the target.

Since an effect as a navigation system and a method is obtained because the target and the travelling line are indicated on the display screen, the contents of display can be simplified, causing a plurality of advantages to be realized.

In a case where the arrow display system, the size of the display screen can be reduced. However, a predetermined size of the display is required in the map display system. In a case where the present position is shown, it must be collated with the circumferential state after it has been confirmed in the map. Therefore, background information must be sufficiently shown in the map, causing a necessity to arise in that the size of the display screen must be enlarged.

On the other hand, since background information is an indispensable factor according to the present invention, the size of the screen can be reduced and as well as a wide area can be displayed as practical and meaningful information.

By combining the navigation system and the method therefor according to the present invention with information about traffic snarl, the user is able to previously detour the snarl. Furthermore, an aid system can be provided with which driving can be performed in such a manner that a driver is able to select a passage to detour the snarl after the driver has confirmed the actual degree of the traffic snarl.

According to the present invention, by combining with a navigation system of another course guide system, it can be provided as information source to freely select the course which is deviated from the instructed course in a case where although the optimum course has been instructed, the moving object is deviated from the optimum course during driving or in a case where the instructed course is not accepted by a female or the aged driver because the traffic volume is too large in the instructed course or the traffic speed is too high in the above-described course.

Brief Description of Drawings

Fig. 1 is a block diagram of a navigation system according to the present invention;
Fig. 2 is a flow chart showing embodiment corresponding to the thirty-fifth invention;
Fig. 3 is a flow chart showing embodiment corresponding to the thirty-seventh invention;
Fig. 4 is a flow chart showing embodiment corresponding to the thirty-ninth invention;
Fig. 5 is a flow chart showing embodiment corresponding to the forty-first invention;
Fig. 6 is a flow chart showing embodiment corresponding to the forty-third invention;
Fig. 7 is a flow chart showing embodiment corresponding to the forty-fifth invention;
Fig. 8 is a flow chart showing embodiment corresponding to the fifty-ninth invention;
and
Figs. 9, 10 and 11 illustrate typical examples of indication on the screen of a display section in a case where the navigation method according to the present invention is carried out.

Best Mode for Carrying Out the Invention

Embodiments of the present invention will now be described hereinafter with reference to the drawings.

The illustrated configuration of a navigation system collectively includes all of the components of the navigation system according to the present invention. It is preferable that the elements of the

system may be selectively employed at the time of a practical use as described later. The sequence illustrated by each of the flow charts partially shows the characteristic sequence of the navigation method according to the present invention. Therefore, they may be combined with one another as desired at a practical use.

As shown in Fig. 1, the navigation system is composed of two units which are a main unit to be mounted on a moving object such as an automobile and an external unit disposed on the outside of the main unit.

A signal 2 emitted from a transmitter 1 disposed on a passage includes data showing the shape and the position of the passage or which the transmitter 1 is disposed, or a code for retrieving the data relating to the passage, or other information about an intersection and a crossing or the like. An orbit satellite 4 irradiates electric waves 5 including information for estimation the position of the moving object. The signal 2 is received by a receiver 3, while the electric waves 5 are received by a receiver 6.

It is preferable that the transmitting section of the transmitter 1 and the receiving section of the receiver 3 are respectively housed in chambers each having members for shielding signals on its side and rear portions and arranged in such a manner that an opening is formed in its front portion. As a result, a directivity in the transmission and the receipt of the signal 2 is given.

An azimuth sensor 7 and a distance sensor 8 are devices for use to estimate the present position of the moving object, the azimuth sensor 7 and the distance sensor 8 being arranged to respectively detect the azimuth and the distance.

A touch panel 9 having a touch panel controller 12, a manipulating section 10 and a voice input section 11 which respectively receive an input operation of an operator. A data storage section 14, stores any one of data about the shape and the position of the passage, information about the intersections and crossings, data about the target and the shape and the position of the passage through which the moving object is able to reach to the target, coordinates and other map data in a manner corresponding to each embodiment of the present invention. A processing section 23 processes a variety of data items to be described later on the basis of programs stored in a storage device which is not shown in Fig. 1. Means for realizing a variety of functions are defined in the processing section 23.

In addition, reference numeral 13 designates a display section, 24 designates an input section, and 25 designates a reading means.

Figs. 9, 10 and 11 illustrate examples of indication on the screen of the display section 13. Referring to these figures, reference numeral 27 designates a target for the moving object to reach, 28 designates the above-described travelling line, 29, 30 and 31 designate the crossings, 32 designates a passage confronting the target, 33 designates a passage with which the passage confronting the target is able to access a main passage, 34 and 35 designate the intersections.

Embodiment corresponding to the first invention:

When information about the passage through which the moving object is moving at this very movement is supplied to the processing section 23 via the input section 24, data about the shape and the position of the passage is read from the data storage section 14 via a retrieval means 15. A display processing means 22 generates the travelling line on the basis of data about the shape and the position of the passage. The travelling line is indicated on the display section 13.

When information about the passage through which the user's vehicle is moving at this very moment is obtained and this passage is indicated, as the travelling line, on the screen of the display section 13, the screen, in principle, always indicates information about the target for the moving object to reach.

In general, the passage is formed into data as a segment between two points given coordinate positions. A deta base of the navigation system according to the present invention relating to the passage is made as follows.

First, the passages are sectioned so as to be formed into data.

The forming of the passages into data is performed in such a manner that data is constituted in units of links which can be obtained by sectioning the passages at the intersections. Furthermore, a code is given to each link so as to make it to be a subject of a retrieval. If there is a characteristic in the shape of the passage, for example, if there is a sharp curve, the shape sometimes is utilized to express the passage.

Data about the link is formed into groups to constitute link groups. The link groups are classified as follows so as to be given codes so that data is made.

As to the passages (it is preferable that each of the passages be formed into the same passage for the impression of the driver) which can be respectively considered as one continuous passage in a general rule data is made in such a manner that the start to the end of the passage is made to be one passage and links which constitute this passage are made to be one group to which a code is given.

A point of advancement from another passage

is made to be a start point and links which constitute a passage from this start point to the end point are formed into one group which constitutes one link group to which a code is given to make data.

A split point of an exclusive right-turn lane or an exclusive left-turn lane, or that of an exclusive movement lane (or a passage), in which vehicles must move, is arranged to be a start point. Furthermore, a course from this start point to the end point of the passage in which the vehicle moves in this lane is arranged to be one passage and links which constitute this passage are formed into one group so as to be given codes as a link group so that data is made.

In each of the cases, it is preferable that a specific code is given to each link and furthermore a common code is given to each of the links which constitute one group in order to perform a data retrieval on the basis of these codes.

The arrangements are the basic one for making the data base. However, it is preferable that the data base about the passage be varied as described in each of the following embodiments.

Embodiment corresponding to the second invention:

The transmitter 1 disposed in a passage transmits the signal 2 including data about the shape and the position of the passage. The signal 2 is received by the receiver 3 of a portable unit which a user has or with which an automobile is provided. The signal 2 is supplied to the input section 24 via the reading means 25. At this time, the area of a plane coordinates in which the passage is positioned is read from the data storage section 14 by the retrieval means 15 in accordance with the coordinate position of the passage or the like. The coordinate data and data about the shape and the position of the passage are indicated on the display section 13 by the display processing means 22. It is preferable at this time that sound be generated to inform the user of the receipt of the signal 2 when the same is received. It is preferable that data included in the signal 2 be data about the shape and the position of the passage from the start point to the end point of the passage, assuming that the start point is the point at which the transmitter 1 is disposed, and thereby the coming portion of the travelling line.

Embodiment corresponding to the third invention:

In the embodiment corresponding to the second invention, data about the position of the transmitter 1 is included in the signal 2. As a result, the position of the transmitter 1 is indicated on the screen of the display section 13 in addition to the travelling line.

Embodiment corresponding to the fourth invention:

A code is included in the signal 2 transmitted from the transmitter 1 disposed in the passage. On the other hand, data about the shape and the position of the passage which corresponds to the code is stored in the data storage section 14 of the portable unit. When the code is, by means of the signal 2, supplied to the processing section 23 via the reading means 25 and the input section 24, data about the shape and the position of the passage is read from the data storage section 14 by the operation of the retrieval means 15. In accordance with retrieved data, the travelling line representing the shape and the position of the passage is then indicated on the display section 13 by the display processing means 22.

Also in this embodiment, it is preferable that the receipt of the signal 2 be informed to a user when the same is received by the sound.

Embodiment corresponding to the fifth invention:

In the embodiment corresponding to the fourth invention, data about the position of the transmitter 1 is included in data to be stored in the data storage section 14 so that the position of the transmitter 1 is indicated on the display section 13 in addition to indicating the travelling line.

Embodiment corresponding to the sixth invention:

Data about the shape and the position of all of the passages are stored in the data storage section 14. Therefore, when a user supplies any one of the name of the passage, that of the intersection, the name of a place, the lot number, the name of a facility positioned on the roadside, the coordinate position or a code number given to it by the key of the manipulating section 10, the touch panel 9, the voice input section 11 or the like, data about the shape and the position of the passage is read from the data storage section 14 by the operations of the input section 24 and the retrieval means 15. As a result, the travelling line is indicated on the display section 13 on the basis of the function of the display processing means 22.

Embodiment corresponding to the seventh invention:

As the equivalent position to be treated in place of the present position of the moving object, position data of a region which is expressed by the intersection and the name of a place or the lot

number, that of the point which is indicated by the facility positioned on the roadside or the coordinates are stored in the data storage section 14 so that the equivalent position is indicated on the display section 13 together with the travelling line.

Embodiment corresponding to the eighth invention:

Information about the passage through which the moving object is moving at this very moment is supplied via the input section 24 connected to the receiver 6 for receiving the electric waves 5, the receiving 3 for receiving the signal 2, the reading means 25, the distance sensor 7 and the azimuth sensor 8. Information thus-supplied is processed in the processing means 16 so that the present place (present position) at which the moving object moves is estimated by a present place estimating means 17. In accordance with the estimated present position, the passage is estimated and discriminated by a passage estimating means 18. After the passage has been discriminated, data about the shape and the position of the passage is read from the data storage section 14 by the retrieval means 15. Furthermore, it is supplied to the display processing means 22 so that the travelling line representing the shape of the passage is indicated on the display section 13.

As a method for discriminating the passage through which the moving object is moving at this very moment on the basis of the estimated present position of the moving object, it is preferable that, for example, an arbitrary points set on the passages are, as data, stored in the data storage section 14 to perform the nearest point retrieval while making the arbitrary points to be the subject. As a method of setting the arbitrary point, it is preferable that plural points should be set at long intervals in one passage in a case where there is no adjacent passage to the one passage, and that the arbitrary point in another passage should be set at a position corresponding to the point set in one passage in a case where there are two passages to be adjacent mutually. As a result of the retrieval performed in such a manner that the arbitrary points are respectively treated as the nearest point to the position of the moving object, the passage is discriminated by utilizing the nearest points.

According to the above-described embodiment, data is retrieved in accordance with the arbitrary point set in the passage, or a link constituting the discriminated passage, to which the arbitrary point belongs. It is preferable that a specific code to a link which constitutes the passage is given in addition to the specific link code to each link to retrieve data about the links. As an alternative to this, it is preferable that a group code for each link group, which is constituted by the links, is given to retrieve data formed into a group by the group code. As an alternative to this, a common code is given to the specific code to the link which constitutes the passage is given to perform retrieval by the common code.

Embodiment corresponding to the ninth invention:

In the embodiment corresponding to the eighth invention 8, a point on the passage nearest to the estimated present position may be, together with the travelling line, indicated on the display section 13.

Embodiment corresponding to the tenth invention:

When a passed passage is discriminated upon a comparison made between the shape of a locus and the shape of the passage based on the stored data, a passage present in front of the passed passage and through which the moving object will run if the moving object does not turn right or left is discriminated by a passage discriminating means 18 on the basis of the discriminated passed passage. Then, data about the shape and the position of the discriminated passage is read from the data storage section 14 by the retrieval means 15. As a result, the travelling line is indicated on the display section 13 by means of the display processing means 22.

According to the above-described embodiment, it is preferable that data be retrieved on the bases of the final link which constitutes the passed passage.

It is preferable that a specific code is given to a link which constitutes the passage from the link to the end point of the same to retrieve data about it, in addition to the specific link code to each link. As an alternative to this, it is preferable that a group code for each link group, which is constituted by the links, is given to retrieve data formed into a group by the group code. As an alternative to this, a common code is given to the specific code to the link which constitutes the passage to the end point of the same to perform retrieval by the common code.

Embodiment corresponding to the eleventh invention:

When the travelling line is indicated on the display section 13, the estimated present position is, as the end point of the locus or the start point of the travelling line, indicated on the display section 13 by means of the display processing means 22.

Embodiment corresponding to the twelfth invention:

The data storage section 14 stores data about the shape and the position of the passages and as well as, together with the state of advancement at the intersection, stores the distance between intersections and the passages which intersect each passage. When information about the start point is, as the initial positional information, supplied through the input section 24, each intersection is descriminated by a intersection discriminating means 19 on the basis of both of the distance from the start point to each intersection calculated in accordance with the stored data, and the actual running distance measured by the distance sensor 8. In accordance with azimuth information detected by the azimuth sensor 7, the passage into which the moving object has been advanced at the intersection is discriminated by the passage discriminating means 18. In accordance with information about the result of the discriminations, data about the shape and the position of the passage into which the moving object has been advance is read from the data storage section 14 by the retrieval means 15.

According to the above-described embodiment, data constituting the discriminated passage is retrieved. It is preferable that a specific code to a link which constitutes the passage from the most forward link to the end point of the passage is given in addition to the specific link code to the most forward link of the passage into which the vehicle has been advanced to retrieve data about them. As an alternative to this, it is preferable that a group code for each link group, which is constituted by the links, is given to retrieve data formed into a group by the group code. As an alternative to this, a common code is given to a specific code to a link which constitutes the passage to its end point is given to perform retrieval by the common code.

Embodiment corresponding to the thirteenth invention:

Although the configuration in the embodiment 12 is arranged in such a manner that the state of the moving object to turn to the right/left is detected by the azimuth sensor 7, this configuration is arranged in such a manner that a user inputs the state of turning to the right/left by any one of the voice input section 11, the touch panel 9, and the key or the switch disposed in the manipulating section 10.

The above-described embodiments corresponding to the twelfth and thirteenth invention may be modified as follows:

As for the initial movement position, it is preferable that a point is previously set, the position of this point is stored in the data storage section 14 and it is then supplied by means of the code given to the point to set the initial movement position.

When the initial movement position is supplied as the coordinate position of an arbitrary point, the distance from the initial movement position to an intersection at which the moving object first turns right or left is detected by the distance sensor 8. The detected distance is stored in the storage means 20 and the same is as well as collated with the distance obtained from a means provided in the intersection discriminating means 19 and arranged to calculate the distance from the initial movement position to each intersection. Thus, the intersection at which the moving object has turned right or left is discriminated by the intersection discriminating means 19.

It is preferable that the configuration be arranged in such a manner that, when the user's vehicle has once turned to the right or left at an intersection, this intersection is, as the initial movement position, stored in the storage means 20 so as to discriminate the intersection at which the vehicle will then turn to the right or left on the basis of the stored data.

It is preferable that the distance from a point, which can be set as the initial movement position, to an intersection on a passage near the point is, together with the initial movement position, stored in the data storage section 14 and make it to be collated with the distance detected by the distance sensor 8. It is preferable that a code for the passage to which the point is set is given to data about the point so as to retrieve data about the passage when the point is set as the initial movement position and it is then indicated as the travelling line on the display section 13.

It is preferable that the point, which is previously set as the initial movement position, be a facility which can easily be made to be a mark such as a gasoline station or a roadside restaurant and which relates the travel of the moving object. In this case, it is supplied as a code given to the facility.

As the point which is previously set as the initial movement position, it is also preferable that a plate or the like which is disposed at the intersection or the passage and given a code number or the like be used.

In a case where the initial movement position is an arbitrary position, it can be set on the screen of the display section 13 by using a cursor or it can be set by means of the latitude and the longitude. In order to calculate the distance, it is preferable that the position be converted into coordinate position.

In a case where the azimuth sensor 7 detects the right turn or the left turn of the user's vehicle, a collation is made between the travelled distance and the detected data about the right turn or the

left turn. If there is not subject intersection, it is preferable that the discrimination of the intersection be cancelled. The case takes place when the lane is changed, the moving object drops in a parking area or a roadside restaurant, or the right turn or the left turn due to a sharp curve passage or the like is detected. When the user inputs the status of the right or the left turn or when azimuth sensor 7 detects it and an effective discrimination of the intersection is thereby made, it is preferable that the cumulative quantity detected by the distance sensor 8 is cancelled and counting is again commenced from zero.

In a case where the user inputs the state of the right turn or the left turn of the user's vehicle, it is preferable that the travelling line is indicated on the display section 13, the nearest intersection positioned forward is shown by an exaggerated enlarged view. Therefore, when the number given to the passage in this enlarged view is input by a key or voice or by directly touching the display screen, the passage to which the user's vehicle will be advanced is discriminated.

As another modification, it is preferable that the state of the advancement be input by voice in such a manner that it is expressed as "right", "upper right", "lower right" and "left". In this case, a configuration can be employed in which each advancement state is given so as to be input by the given number or the same is input in another language such as English.

Another modification may be employed which is constituted in such a manner that keys or switches are disposed at the top end portion, the intermediate portion and the lower portion of the right side of the screen frame of the display section 13, the top end portion, the intermediate portion and the lower portion of the left side of the same and the right portion and the left portion of the lower side of the same to correspond to the state of the advancement, that is, the upper right, right, lower right, upper left, left, lower left and U-turn.

Embodiment corresponding to the fourteenth invention:

In a case where information about the passage through which the user's vehicle is moving at this very moment includes information about the present position of the vehicle, data about the shape and the position of the subject passage from the present position to the end point of the passage is retrieved from data stored in the data storage section 14 to indicate the forward portion of the passage through which the vehicle is moving is at this very moment, as the travelling line, on the display section 13 on the basis of the retrieved data.

Embodiment corresponding to the fifteenth invention:

When the travelling line and the locus are indicated on the display section 13, the travelling line and the locus are indicated by different kinds of lines or different colors.

Embodiment corresponding to the sixteenth invention:

The display mode on the display section 13 may be arranged in such a manner that the shape and the position of the passage through which the moving object is moving at this very moment are indicated as the travelling line, and furthermore, the shape and the position of another passage which intersects the passage through which the moving object is moving at this very moment are indicated as intersection lines 29, 30 and 31.

In this case, it is preferable that the travelling line and the intersection line be indicated in different colors or different kinds of lines.

Embodiment corresponding to the seventeenth invention:

It is preferable that the travelling line and the locus are indicated by different kinds of lines or different colors on the display section.

Embodiment corresponding to the eighteenth invention:

As a display mode on the display section 13, the position of the intersection may be, together with the travelling line and the intersection line, indicated or the same may be indicated in place of the travelling line and the intersection line.

Embodiment corresponding to the nineteenth, twentieth and twenty-first invention:

As a display mode on the display section 13, the direction of the travel or the direction in which the moving object must travel may be indicated by using an arrow or the like in addition to the travelling line.

Embodiment corresponding to the twenty-second invention:

The travelling direction can be indicated on the display section 13 on the basis of the detection of the travelling direction obtained by the azimuth sensor 7.

Furthermore, when the present position is estimated in accordance with the satellite electric

waves 5, a means for storing the estimated point and indicating this point on the screen of the display section 13 is provided, wherein the travelling direction is indicated by continuous points, or a direction in the direction of extension of a line connecting two or more continuous points including the final point is defined as the travelling direction, whereby the travelling direction discriminating means 21 discriminates the travelling direction in accordance with the above-made definition so as to indicate the travelling direction on the display section 13 by an arrow or the like.

Embodiment corresponding to the twenty-third invention:

It is preferable that the locus be indicated together with the travelling line on the screen of the display section 12.

Embodiment corresponding to the twenty-fourth invention:

It is preferable that the estimated passed intersection should be stored in the storage means 20 and be indicated in the display section 13 together with the travelling line.

Embodiment corresponding to the twenty-fifth invention:

As a display mode to be made on the display section 13, the present position or the equivalent position in place of the present position can be indicated on the display section 13. Furthermore, it is preferable that the present position or the equivalent position in place of the present position be stored in the storage means 20 and a sequential plurality of stored points are indicated together with the travelling line.

Embodiment corresponding to the twenty-sixth invention:

The configuration can be formed in such a manner that, in a case where input information for retrieving data about the shape and the position of the passage to be indicated as the travelling line includes information about the present position of the moving object, an area to which both the present position and the target position for the moving object belong is retrieved so as to indicate the area on the display section 13, and in addition, the target position, a travelling line having the present position or the equivalent position in place of the present position thereon may be indicated on the display section 13.

It is preferable that the area to which both the coordinate position of the present position or that of the equivalent position in place of the present position and that of the target coordinate position belong be retreived. As an alternative to this, it is preferable that codes for a small area and a large area set to several stages as being a different reduced scale to meet a desire are given to a signal transmitted by the transmitter 1, data to be retrieved in response to this signal, data to be retrieved by the name of the intersection, the name of a place, a lot number, the roadside facility or the like which is supplied by the user, data to be retrieved by the present position or the passed passage estimated in accordance with the result of the satellite electric wave or the detection made by each sensor or data to be retrieved by the intersection at which the moving object has been advanced into a different passage. Also data about the target position is given the similar area code, whereby a code which is common to them is retrieved.

It is preferable that the area codes for them be retrieved in such a manner that the sequential collation is started from a small area code to retrieve a code which is common to them. As an alternative to this, the sequential collation is started from a large area code until the area becomes different in a small area, and then a restoration to the common area is made.

As an alternative to this, a configuration can be employed which is arranged in such a manner that a large area to which both the target and the travelling line belong is displayed, a frame which can be moved and the size of which can be changed is provided in the display screen and an area to which both the target and the travelling line belong is determined and selected by the user's operation of the frame so as to display this area. As an alternative to this, either of the target or the travelling line is first indicated on the display screen and the area is sequentially changed to a large area by the user until they belong to the same area.

Embodiment corresponding to the twenty-seventh invention:

The configuration is constituted in such a manner that the position of a target for the moving object is stored in the data storage section 14 together with data about the shape and the position of the passage at which the target confronts. It is preferable that data about the position of the target be retrieved by the retrieval means 15 when the target is set and as well as data of the shape and the position of the passage which confronts the target be retrieved to indicate the position of the target, the shape and the position of the passage on the display section 13.

If a variety of regulations are applied to the passage, for example, if there is a directional regulation, it may be shown by an arrow or the like or the sections through which the vehicle can or cannot pass in the passage at which the target confronts it may be expressed by different colors or different kinds of lines, on the screen of the display section 13.

It is preferable that the vehicle type regulation, the hour regulation and weight regulation be indicated on the display section 13 on the basis of the selection made by the user.

Embodiment corresponding to the twenty-eighth invention:

The configuration is constituted in such a manner that data about the shape and the position of the passage which constitutes a course through which the vehicle is able to properly and correctly reach from a main passage adjacent to the target is stored in the data storage section 14. It is preferable that, when a target is set, the target and the shape and the position of the passage through which the vehicle reaches this target be indicated on the screen of the display section 13.

It is preferable that passages constituting a course to be practically advantageous should be indicated on the display screen in accordance with the regulations of the law together with the target, and furthermore the passed intersections and their names, marks for them or the like should be indicated similarly.

It is preferable that the main passage which is connected to the passage indicated together with the target and another passage which is connected to the main passage when the main passage is indicated together with the target are stored in the data storage portion 14, whereby, when the above-described another passage is retrieved as the passage for the user's vehicle, a message "target accessed" is informed to the user by voice or image.

Embodiment corresponding to the twenty-ninth invention:

It is preferable that, when a target is set, a target direction, the start point of which is made to be the present position or an equivalent position in place of the present position, be discriminated by a target direction discrimination means 26 and as well as the discriminated target direction be indicated by an arrow or the like together with the travelling line on the display section 13.

In a case where the travelling line is indicated while being given a priority on the display screen, for example, in a case where the target cannot be indicated on the display screen because an enlarged view is displayed on the screen of the display section 13 as a result of passing through a passage which puzzles the user or a complicated passage, it is preferable that the target direction should be indicated.

Embodiment corresponding to the thirtieth invention:

The configuration can be constituted in such a manner that, when a target is set, the target direction, the start point of which is a central point or an arbitrary point in the area displayed on the display section 13 which indicates the travelling line, is discriminated by the target direction discriminating means 26. The discriminated target direction is, together with the travelling line, indicated by an arrow or the like on the display section 13.

It is preferable that, in a case where the travelling line is indicated while being given a priority on the display screen, for example, in a case where the target cannot be clearly indicated on the display screen because an enlarged view is displayed on the display screen as a result of passing through a passage which puzzles the user or a complicated passage, or in a case where information about the present position cannot be obtained, the target direction should be indicated.

Embodiment corresponding to the thirty-first invention:

It is preferable that the receiving section of the portable unit is housed in a housing having member for shielding signals on its side and rear portions and arranged in such a manner that an opening is formed in its front portion.

Embodiment corresponding to the thirty-second invention:

It is preferable that the transmitting section of the transmitter is housed in a housing having member for shielding signals on its side and rear portions and arranged in such a manner that an opening is formed in its front portion.

Embodiment corresponding to the thirty-third invention:

It is preferable that, when a novel information item as to the passage through which the user's vehicle is moving at this very moment, which is different from information which has been previously supplied, is supplied, data about the novel passage through which the user's vehicle is moving at this very moment is retrieved in accordance with

the novel information item and a corresponding travelling line is indicated on the display screen, both the travelling line to be indicated in accordance with the previous input information and the travelling line to be indicated in accordance with the novel input information should be indicated and they should be indicated by different lines or different colors so as to distinguish them.

Then, the contents of the processing operation to be performed by the processing section 23 will now be described with reference to flow charts shown in the figures.

Embodiment corresponding to the thirty-fourth invention:

When information about the passage through which the moving object is moving at this very moment is inputted to the main unit, the travelling line representing the passage through which the moving object is moving at this very moment is indicated on the screen of the display section on the basis of the inputted information. The navigation method of the present invention having such a feature can be executed as follows.

Embodiment corresponding to the thirty-fifth invention:

The signal 2 is, as shown in Fig. 2, received by the receiver 3 (step 1). Then, data about the shape and the position of the passage through which the user's vehicle is moving at this very moment is read (step 2) so as to retrieve an area which corresponds to the read passage (step 3). Then, the area and the travelling line are indicated on the screen of the display section 13 (step 4).

Embodiment corresponding to the thirty-seventh invention:

As shown in Fig. 3, the signal including the code is received by the receiver 3 (step 1). Then, the code included in the signal is read (step 2) so as to retrieve data about the passage which corresponds to the above-described code from the data storage section 14 (step 3). Then, the travelling line is indicated on the screen of the display section 13 (step 4).

Embodiment corresponding to the thirty-ninth invention:

Another navigation method is, as shown in Fig. 4, constituted in such a manner that information about the passage through which the user's vehicle is moving at this very moment is supplied by the user by operating the manipulating section 10 or the like (step 1). Then, data about the passage which corresponds to supplied information is retrieved from the data storage section 14 (step 2) so as to indicate the travelling line representing the shape and the position of the retrieved passage on the screen of the display section 13 (step 3).

Embodiment corresponding to the forty-first invention:

Another navigation method is arranged is such a manner that, when information obtained from the satellite electric waves 5 or the sensors 8 and 10 is, as shown in Fig. 5, supplied (step 1), the present position of the user's vehicle is estimated in accordance with supplied information (step 2). Then, the passage corresponding to the estimated present position is discriminated (step 3) so as to data for indicating the travelling line which corresponds to the above-described passage is retrieved from the data storage section 14 (step 4). Then, the travelling line is indicating on the screen of the display section 13 (step 5).

Embodiment corresponding to the forty-third invention:

A further navigation method is, as shown in Fig. 6, constituted in such a manner that, when information of the satellite electric wave 5 or that obtained as a result of the detection performed by the sensors 8 and 10 is supplied (step 1), the present position of the user's vehicle is estimated in accordance with the supplied information and a locus for the user's vehicle is obtained in accordance with a plurality of estimated present positions (step 2). Then, the locus thus-obtained and a passage stored in the data storage section 14 are subjected to a comparison (step 3). As a result of this comparison, the passed passage is discriminated (step 4) so as to retrieve data about the forward passage from the data storage section 14 in accordance with the passed passage (step 5). Then, a travelling line representing the shape and the position of the retrieved passage is indicated on the screen of the display section 13 (step 6).

Embodiment corresponding to the forty-fifth invention:

Another navigation method is, as shown is Fig. 7, arranged in such a manner that the initial movement position is set (step 1). Then, the travelled distance from the initial movement position is detected (step 2) so as to store the detected travelled distance (step 3). Furthermore, the distance from the initial movement position to each intersection is obtained in accordance with data (step 4). Then,

the intersection which is passed is estimated from the result of a comparison made between the above-described distance and the above-described detected travelled distance (step 5). Then, the state of the advancement into the intersection is detected (step 6) to estimate the advanced passage (step 7), retrieve data about the advanced passage (step 8) and indicate the travelling line on the screen of the display section 13 in accordance with the retrieved data (step 6).

According to the embodiment corresponding to the forty-sixth invention, the navigation method shown in Fig. 7 may be arranged in such a manner that the travelling line is indicated by a user by inputting the state of the advancement into the intersection by operating the manipulating section 10 in step 6.

Embodiment corresponding to the fifty-ninth invention:

Another navigation method is, as shown in Fig. 8, arranged in such a manner that, when the name or the code of a target is supplied (step 1), data about the target is retrieved (step 2) and the target is indicated on the screen of the display section 13 in accordance with the data (step 3). If information about the passage through which the user's vehicle is moving at this very moment is supplied at this time (step 4), a signal concerning the information is read or data concerning the passage is retrieved (step 5). Then, an area to which both the present position or an equivalent position in place of the present position and the target belong is retrieved (step 6) so that the above-described area is displayed on the screen of the display portion 13. Thus, the target and the travelling line are indicated on the display screen (step 7). The above-described navigation method corresponds to the embodiment 24.

Industrial Applicability

As described above, the navigation system and the method therefor according to the present invention are optimum to be mounted on a vehicle while making a driver to be the subject. Furthermore, it can be used as a portable navigation system for a pedestrian.

Claims

1. A navigation system having a storage section, a central processing section, an input section and a display section, comprising means for inputting information about a passage through which a moving object is moving at this very moment, and means for indicating a line (hereinafter referred to as a travelling line) representing said passage through which said moving object is moving at this very moment on said display section when said inputting means inputs said information.

2. A navigation system according to claim 1, comprising a transmitting device disposed in each passage, means for supplying data about the shape and the position of said passage to a signal transmitted from said transmitting device, a receiving section established in a portable unit, means for reading a received signal, a storage section for storing plane coordinates, means for retrieving an area on said plane coordinate in which said passage exists on the basis of information read by said reading means, and means for indicating said travelling line representing said passage through which said moving object is moving at this very moment on said display section on the basis of said data about the shape and the position of said passage and data about said retrieved area on said plane coordinate.

3. A navigation system according to claim 2, comprising means for supplying data about a position of said transmitting device disposed in said passage to the signal transmitted from said transmitting device, and indicating said position of the transmitting device from which said signal is transmitted at this very moment, together with said travelling line.

4. A navigation system according to claim 1, comprising a transmitting device disposed in each passage, means for supplying a code to a signal transmitted from said transmitting device, a receiving section established in a portable unit, means for reading a received signal, means for storing said data about the shape and the position of each passage in a storage section of said portable unit, means for retrieving data about the shape and the positions of a passage in which said transmitting device is disposed on the basis of a signal retrieved from said signal which said transmitting device transmits, and means for indicating said travelling line representing said passage in which said moving object is moving at this very moment on said display section on the basis of said retrieved data.

5. A navigation system according to claim 4, comprising means for storing a position of said transmitting device in said storage section of said portable unit, means for retrieving said data about the shape and the position of said

passage and data about the position of said transmitting device on the basis of said code obtained by said reading means, and means for indicating said position of the transmitting device from which said signal is transmitted at this very moment, together with said travelling line.

6. A navigation system according to claim 1, comprising a storage section for storing data about the shape and the position of each passage, input means, such as keys, a touch-screen and a voice input device, for inputting various information items which can be recognized by a user at the time of travelling said passage and with which said passage can be specified, for example, such as the name of a passage, the name of an intersection, the name of a place, a lot number, the name of a facility on roadside and the coordinate position, or a code number given to each of these items, means for retrieving data about the shape and the position of said passage which is defined by said information item inputted by the user from said storage section on the basis of said inputted information item, and means for indicating said travelling line representing said passage on said display section on the basis of said retrieved data.

7. A navigation system according to claim 6, comprising means for storing verious positions, such as a position of said intersection, a position of region represented by the place name and the lot number, a position of the facility and a position of the place indicated by the coordinate, means for retrieving the data of said passage and said verious positions on the basis of said information items inputted by the user, and means for indicating said retrieved positions on said display section together with said travelling line.

8. A navigation system according to claim 1, comprising means for estimating a present position of said moving object on the basis of electric waves emitted by a satellite, or means for estimating the present position on the basis of a sensor for detecting a distance and a direction, means for storing data about the shape and the position of each passage, means for discriminating a passage nearest to the present position estimated by said estimating means, and means for retrieving data about the shape and the position of said passage from data stored in said storage section, wherein said indicating means indicates the shape and the positions of said passage as said travelling line representing said passage through which said moving object is moving at this very moment on said display section on the basis of said retrieved data.

9. A navigation system according to claim 8, comprising means for retrieving data about a point near to the estimated present position on said travelling line when discriminating said passage nearest to the estimated present position, retrieving said data about said passage, and indicating said travelling line.

10. A navigation system according to claim 1, comprising means for estimating a present position of said moving object on the basis of electric waves emitted by a satellite, or means for estimating the present position on the basis of a sensor for detecting a distance and a direction, said storage section for storing data about the shape and the position of each passage, means for retrieving data about the shape and the position of a passage which is in front of a passage discriminated as a passed passage by comparing the shape of the passage and the shape of a locus obtained on the basis of the estimated present position and which will be a passage when no turning to right/left is made, from data stored in said storage section, wherein said indicating means indicates the shape and the position of said passage as said travelling line representing said passage through which said moving object is moving at this very moment on said display section on the basis of said retrieved data.

11. A navigation system according to claim 10, wherein said travelling line is indicated in such a manner that said estimated present position is made to be the end point of said locus or the start point of said travelling line.

12. A navigation system according to claim 1, comprising a storage section for storing data about the shape and the position of each passage, a distance sensor for detecting a travelled distance, an azimuth sensor for detecting a direction of a travel, means for storing passages intersecting each passage together with a state of advancement at each intersection, means for storing the distance between intersections in each passages, means for setting an initial movement position, means for detecting the distance from said initial movement position, means for storing the detected quantity of the distance, means for obtaining the distance from said initial movement position to

each intersection, means for collating said distance and said detected quantity, means for estimating intersection passed at the time of said detection when said collation has been made, means for, when said azimuth sensor detects the state of advancement into an intersection, estimating a passage into which an advancement is made on the basis of said detected state, means for retrieving data about the shape and the position of said passage into which said advancement is made from data stored in said storage section, and means for indicating said travelling line representing the shape and the position of said passage on the basis of said retrieved data.

13. A navigation system according to claim 1, comprising a storage section for storing data about the shape and the position of each passage, a distance sensor for detecting a travelled distance, means for inputting, by a user, a state of advancement at an intersection from a passage to another passage, means for storing passages intersecting each passage together with a state of advancement at each intersection, means for storing the distance between intersections in each passages, means for setting an initial movement position, means for detecting the distance from said initial movement position, means for storing the detected quantity of the distance, means for obtaining the distance from said initial movement position to each intersection, means for collating said distance and said detected quantity, means for estimating intersection passed at the time of said detection when said collation has been made, means for estimating a passage into which an advancement is made on the basis of said state of advancement into another passage at said intersection supplied by said user, means for retrieving data about the shape and the position of said passage into which said advancement is made from data stored in said storage section, and means for indicating said travelling line representing the shape and the position of said passage on the basis of said retrieved data.

14. A navigation system according to claim 1, in a case where said information about the passage through which said moving object is moving at this very moment includes the present position of said moving object, further comprising means for retrieving data about the shape and the position of said passage from said present position to the end point of said passage from data stored in said strage section, and means for indicating the forward portion of said passage through which said moving object is moving at this very moment as said travelling line on the basis of the retrieved data.

15. A navigation system according to claim 1, comprising means for estimating a present position, and means for storing passed positions or means for storing a locus and the like, wherein both said travelling line and said locus are indicated on said display section, further comprising means for indicating said travelling line and said locus by a different kinds of lines or different colors.

16. A navigation system according to claim 1, in a case where a transmitting device is disposed in each passage and said transmitting device transmits a signal including data about the shape and the position of a passage in which said transmitting device is disposed, said signal includes data about the shape and the position of another passage which intersects said passage, and further comprising means for indicating the shape and the position of said another passage as an intersection line on the display section together with said travelling line representing said passage through which said moving object is moving at this very moment.

17. A navigation system according to claim 1, in a case where said data about the shape and the position of each passage is stored in said storage section, further comprising means for retrieving data about the shape and the position of said passage through which said moving object is moving at this very moment on the basis of inputted information and said storage section storing data about the shape and the position of another passage which intersects each passage, and means for indicating the shape and the position of said another passage as an intersection line on the display section together with said travelling line representing said passage through which said moving object is moving at this very moment.

18. A navigation system according to claim 1, wherein said storage section stores data about the shape and the position of each passage and data about each position of intersections in each passage, and said indication means indicating the positions of said intersections on said display section together with said travelling line and intersection lines, or in place of said travelling line and said intersection lines.

19. A navigation system according to claim 2, in a

case where said signal has a directivity, or the reachable distance of said signal is limited, or when receiving said signal, an instruction as to which direction a user should face and an indication of an understandable instruction are given to the user, and a direction to be travelled is determined in the passage where the user can receive said signal by laws or pratical viewpoints, further comprising means for giving information about said determined direction to said signal, and means for indicating said determined direction by an arrow or the like on said display section as a travelling direction or a direction to be travelled, together with said travelling line.

20. A navigation system according to claim 4, in a case where said signal has a directivity, or the reachable distance of said signal is limited, or when receiving said signal, an instruction as to which direction a user should face and an indication of an understandable instruction are given to the user, and a direction to be travelled is determined in the passage where the user can receive said signal by laws or practical viewpoints, further comprising means for storing data about said determined direction in said storage section together with data about the shape and the position of each passage, means for giving a code used for retrieving said both data, and means for indicating said determined direction by an arrow or the like on said display section as a travelling direction or a direction to be travelled, together with said travelling line, on the basis of said retrieved data.

21. A navigation system according to claim 6, when said information item which the user recognizes and can input by said input section is an indication which can be recognized by only a user who is travelling in said passage in accordance with a direction determined by laws or practical viewpoints, or when said information item is an object to be recognized by only said user in generally accepted idea, further comprising means for storing data about said determined direction in said storage section together with data about the shape and the position of said passage retrieved on the basis of said information, and means for indicating said determined direction by an arrow or the like on said display section as a travelling direction or a direction to be travelled, together with said travelling line.

22. A navigation system according to claim 8, when having an azimuth sensor, comprising means for indicating a travelling direction on the basis of the detection due to said azimuth sensor, or when estimating the present point on the basis of the electric waves from the satellite, comprising means for storing the estimated point and means for indicating the estimated point on the display section, and means for indicating said travelling direction by an arrow on the like on the display section, said travelling direction is defined as the direction determined by said continuous points or as the direction of extension of a line connecting two or more continuous points including a final point.

23. A navigation system according to claim 10, comprising means for indicating said locus on the display section together with said travelling line.

24. A navigation system according to claims 12 and 13, comprising means for storing the position of the estimated passed intersectioin and means for indicating said intersection together with said travelling line on the display section.

25. A navigation system according to claims 3, 5, 7, 9 and 11. comprising means for indicating and storing said present position or the equivalent position, and means for indicating a series of said stored positions on said display section together with said travelling line.

26. A navigation system according to claim 1, in the configuration comprising means for inputting a target by a coordinate position by using a key, a touchscreen, a voice input device or the like, or means for storing the coordinate position of the target in said storage section, means for inputting a code such as a number or name by the operation of a user, the code which is given to said target together with the name of the target and which is written in a collation table, means for retrieving data of the target on the basis of the inputted information, means for indicating the position of the target on said display section on the basis of the retrieved data, in a case where said inputted information used for retrieving data about the shape and the postion of said passage indicated as said travelling line includes information as to the present position, further comprising means for retrieving an area to which the target position and the present position belong, and means for indicating said area, said target position, and said travelling line on which the present position or an equivalent position in place of the present invention is placed on the

display section.

27. A navigation system according to claim 1 and 26, comprising means for storing the position of said target by a coordinate position and data about the shape and the position of a passage at which the target confronts in said storage section, means for retrieving data about the position of said target when setting said target and for retrieving data about the shape and the position of said passage, and means for indicating the shape and the position of said passage on the display section together with the position of said target.

28. A navigation system according to claim 27, comprising means for storing data about the shape and the position of a passage at which the target confronts and data about the shape and the position of a passage which constitutes a course through which the moving object is able to properly and correctly reach from a main passage adjacent to the target in said storage section, means for retrieving data of the position of said target and data about the shape and the position of said passage at which said target confronts and for retrieving data about the shape and the position said passage constituting said course, and means for indicating the shape and the position of said passage constituting said course on said display section together with the position of said target and the shape and the position of said passage at which said target confronts.

29. A navigation system according to claim 1, in a case where means for inputting and setting a target is comprised, when setting said target, comprising means for retrieving a target direction, the start point of which is made to be a present position or an equivalent position in place of the present position, and means for indicating said target direction by an arrow or the like on said display section together with said travelling line.

30. A navigation system according to claim 1, in a case where means for inputting and setting a target is comprised, when setting said target, comprising means for retrieving a target direction while making an arbitrary point of an area on said display section to be a start point, and means for indicating said target direction by an arrow or the like on said display section together with said travelling line.

31. A navigation system according to claims 2 and 4, said receiving section of said portable unit is housed in a housing which is opened in its front portion and has member for shielding signals on its side and rear portions.

32. A navigation system according to claims 2 and 4, said transmitting section of said transmitter is housed in a housing which is opened in its front portion and has member for shielding signals on its side and rear portions.

33. A navigation system according to claim 1, when as to said passage through which said moving object is moving at this very moment novel information different from said information which has been supplied is supplied, and data is retrieved by said information and said travelling line is indicated on the basis of said data, comprising means for indicating both said travelling lines respectively by said previous information and said novel information in a manner that said two lines are indicated by different kinds of lines or different colors.

34. A navigation method of storing data, processing information when said information is inputted, and performing an indication, comprising the step of indicating a line (hereinafter referred to as a travelling line) representing a passage through which a moving object is moving at this very moment on a display section, when information as to said passage through which said moving object is moving at this very moment is inputted.

35. A navigation method according to claim 34, comprising the steps of disposing a transmitting device in each passage, supplying data about the shape and the position of said passage to a signal transmitted from said transmitting device, establishing a receiving section in a portable unit, reading said signal when inputting said signal, having a storage section for storing plane coordinates, retrieving an area on said plane coordinate in which said passage exists on the basis of said read information, and indicating said travelling line representing said passage through which said moving object is moving at this very moment on said display section on the basis of said data about the shape and the position of said passage and data about said retrieved area on said plane coordinate.

36. A navigation method according to claim 35, comprising the steps of supplying data about a position of said transmitting device disposed in said passage to the signal transmitted from said transmitting device, and indicating said

position of the transmitting device from which said signal is transmitted at this very moment, together with said travelling line.

37. A navigation method according to claim 34, comprising the steps of disposing a transmitting device in each passage, supplying a code to a signal transmitted from said transmitting device, establishing a receiving section in a portable unit, reading said signal when inputting said signal, storing said data about the shape and the position of each passage in a storage section of said portable unit, retrieving data about the shape and the position of a passage in which said transmitting device is disposed on the basis of a signal retrieved from said signal which said transmitting device transmits, and indicating said travelling line representing said passage in which said moving object is moving at this very moment on said display section on the basis of said retrieved data.

38. A navigation method according to claim 37, comprising the steps of storing a position of said transmitting device in said storage section of said portable unit; retrieving said data about the shape and the position of said passage and data about the position of said transmitting device on the basis of said code obtained by said reading means, and indicating said position of the transmitting device from which said signal is transmitted at this very moment, together with said travelling line.

39. A navigation method according to claim 34, comprising the steps of storing data about the shape and the position of each passage, inputting various information items which can be recognized by a user at the time of travelling said passage and with which said passage can be specified, for example, such as the name of a passage, the name of an intersection, the name of a place, a lot number, the name of a facility on roadside and the coordinate position, or a code number given to each of these items, retrieving data about the shape and the position of said passage which is defined by said information item inputted by the user on the basis of said inputted information item, and indicating said travelling line representing said passage on said display section on the basis of said retrieved data.

40. A navigation method according to claim 39, comprising the steps of storing verious positions, such as a position of said intersection, a position of region represented by the place name and the lot number, a position of the facility and a position of the place indicated by the coordinate, retrieving the data of said passage and said verious positions on the basis of said conformation items inputted by the user, and indicating said retrieved positions on said display section together with said travelling line.

41. A navigation method according to claim 34, comprising the steps of estimating a present position of said moving object on the basis of electric waves emitted by a satellite, or estimating the present position on the basis of a sensor for detecting a distance and a direction, storing data about the shape and the position of each passage, discriminating a passage nearest to the present position estimated in said estimating step, retrieving data about the shape and the position of said passage from the stored data and indicating the shape and the position of said passage as said travelling line representing said passage through which said moving object is moving at this very moment on said display section on the basis of said retrieved data.

42. A navigation method according to claim 41, comprising the steps of retrieving data about a point near to the estimated present position on said travelling line when discrimination said passage nearest to the estimated present position, retrieving said data about said passage, and indication said travelling line.

43. A navigation method according to claim 34, comprising the steps of estimating a present position of said moving object on the basis of electric waves emitted by a satellite, or estimating the present position on the basis of a sensor for detecting a distance and a direction, storing data about the shape and the position of each passage, retrieving data about the shape and the position of a passage which is in front of a passage discriminated as a passed passage by comparing the shape of the passage and the shape of a locus obtained on the basis of the estimated present position and which will be a passage when no turning to right/left is made, from data stored in said storage section, and indicating the shape and the position of said passage as said travelling line representing said passage through which said moving object is moving at this very moment on said display section on the basis of said retrieved data.

44. A navigation method according to claim 43,

wherein said travelling line is indicated in such a manner that said estimated present position is made to be the end point of said locus or the start point of said travelling line.

45. A navigation method according to claim 34, comprising the step of storing data about the shape and the position of each passage, detecting a travelled distance, detecting a direction of a travel, storing passages intersecting each passage together with a state of advancement at each intersection, storing the distance between intersections in each passages, setting an initial movement position, detecting the distance from said initial movement position, storing the detected quantity of the distance, obtaining the distance from said initial movement position to each intersection, collating said distance and said detected quantity, estimating intersection passed at the time of said detection when said collation has been made, estimating a passage into which an advancement is made on the basis of said detected state when detecting the state of advancement into an intersection, retrieving data about the shape and the position of said passage into which said advancement is made from the stored data, and indicating said travelling line representing the shape and the position of said passage on the basis of said retrieved data.

46. A navigation method according to claim 34, comprising the steps of storing data about the shape and the position of each passage, detecting a travelled distance, inputting, by a user, a state of advancement at an intersection from a passage to another passage, storing passages intersecting each passage together with a state of advancement at each intersection, storing the distance between intersections in each passages, setting an initial movement position, detecting the distance from said initial movement position, storing the detected quantity of the distance, obtaining the distance from said initial movement position to each intersection, collating said distance and said detected quantity, estimating intersection passed at the time of said detection when said collation has been made, estimating a passage into which an advancement is made on the basis of said state of advancement into another passage at said intersection supplied by the user, retrieving data about the shape and the position of said passage into which said advancement is made from the stored data, and indicating said travelling line representing the shape and the position of said passage on the basis of said retrieved data.

47. A navigation method according to claim 34, in a case where said information about the passage through which said moving object is moving at this very moment includes the present position of said moving object, further comprising the steps of retrieving data about the shape and the position of said passage from said present position to the end point of said passage from the stored data, and indicating the forward portion of said passage through which said moving object is moving at this very moment as said travelling line on the basis of the retrieved data.

48. A navigation method according to claim 34, when comprising the steps of estimating a present position, storing passed positions or storing a locus and the like, wherein both said travelling line and said locus are indicated on said display section, further comprising the step of indicating said travelling line and said locus by a different kinds of lines or different colors.

49. A navigation method according to claim 34, in a case where a transmitting device is disposed in each passage and said transmitting device transmits a signal including data about the shape and the position of a passage in which said transmitting device is disposed, said signal includes data about the shape and the position of another passage which intersects said passage, and further comprising the step of indicating the shape and the position of said another passage as an intersection line on the display section together with said travelling line representing said passage through which said moving object is moving at this very moment.

50. A navigation method according to claim 34, in a case where said data about the shape and the position of each passage is stored, further comprising the steps of retrieving data about the shape and the position of said passage through which said moving object is moving at this very moment on the basis of inputted information, storing data about the shape and the position of another passage which intersects each passage, and indicating the shape and the position of said another passage as an intersection line on the display section together with said travelling line representing said passage through which said moving object is moving at this very moment.

51. A navigation system according to claim 1, wherein said storage section stores data about the shape and the position of each passage

and data about each position of intersections in each passage, and said indication means indicating the positions of said intersections on said display section together with said travelling line and intersection lines, or in place of said travelling line and said intersection lines.

52. A navigation method according to claim 35, in a case where said signal has a directivity, or the reachable distance of said signal is limited, or when receiving said signal, an instruction as to which direction a user should face and an indication of an understandable instruction are given to the user, and a direction to be travelled is determined in the passage where the user can receive said signal by laws or pratical viewpoints, further comprising the steps of giving information about said determined direction to said signal, and indicating said determined direction by an arrow or the like on said display section as a travelling direction or a direction to be travelled, together with said travelling line.

53. A navigation method according to claim 37, in a case where said signal has a directivity, or the reachable distance of said signal is limited, or when receiving said signal, an instruction as to which direction a user should face and an indication of an understandable instruction are given to the user, and a direction to be travelled is determined in the passage where the user can receive said signal by laws or practical viewpoints, further comprising the steps of storing data about said determined direction in said storage section together with data about the shape and the position of each passage, giving a code used for retrieving said both data, and indicating said determined direction by an arrow or the like on said display section as a travelling direction or a direction to be travelled, together with said travelling line, on the basis of said retrieved data.

54. A navigation method according to claim 39, when said information item which the user recognizes and can input by said input section is an indication which can be recognized by only a user who is travelling in said passage in accordance with a direction determined by laws or practical viewpoints, or when said information item is an object to be recognized by only said user in generally accepted idea, further comprising the steps of storing data about said determined direction in said storage section together with data about the shape and the position of said passage retrieved on the basis of said information, and indicating said determined direction by an arrow or the like on said display section as a travelling direction or a direction to be travelled, together with said travelling line.

55. A navigation method according to claim 41, when having an azimuth sensor, comprising the steps of indicating a travelling direction on the basis of the detection due to said azimuth sensor, or when estimating the present point on the basis of the electric waves from the satellite, storing the estimated point and indicating the estimated point on the display section, and indicating said travelling direction by an arrow or the like on the display section, said travelling direction is defined as the direction determined by said continuous points or as the direction of extension of a line connecting two or more continuous points including a final point.

56. A navigation method according to claim 43, comprising the step of indicating said locus on the display section together with said travelling line.

57. A navigation system according to claims 45 and 46, comprising means for storing the position of the estimated passed intersection and means for indicating said intersection together with said travelling line on the display section.

58. A navigation method according to claims 36, 38, 40, 42 and 44, comprising the steps of indicating and storing said present position or the equivalent position, and indicating a series of said stored positions on said display section together with said travelling line.

59. A navigation method according to claim 34, in the configuration comprising the steps of inputting a target by a coordinate position by using a key, a touchscreen, a voice input device or the like, or storing the coordinate position of the target in said storage section, inputting a code such as a number or name by the operation of a user, the code which is given to said target together with the name of the target and which is written in a collation table, retrieving data of the target on the basis of the inputted information, means for indicating the position of the target on said display section on the basis of the retrieved data, in a case where said inputted information used for retrieving data about the shape and the position of said passage indicated as said travelling line includes information as to the present position, further comprising the steps of retrieving an

area to which the target position and the present position belong, and indicating said area, said target position, and said travelling line on which the present position or an equivalent position in place of the present invention is placed on the display section.

60. A navigation method according to claim 34 and 50, comprising the steps of storing the position of said target by a coordinate position and data about the shape and the position of a passage at which the target confronts in said storage section, retrieving data about the position of said target when setting said target, retrieving data about the shape and the position of said passage, and indicating the shape and the position of said passage on the display section together with the position of said target.

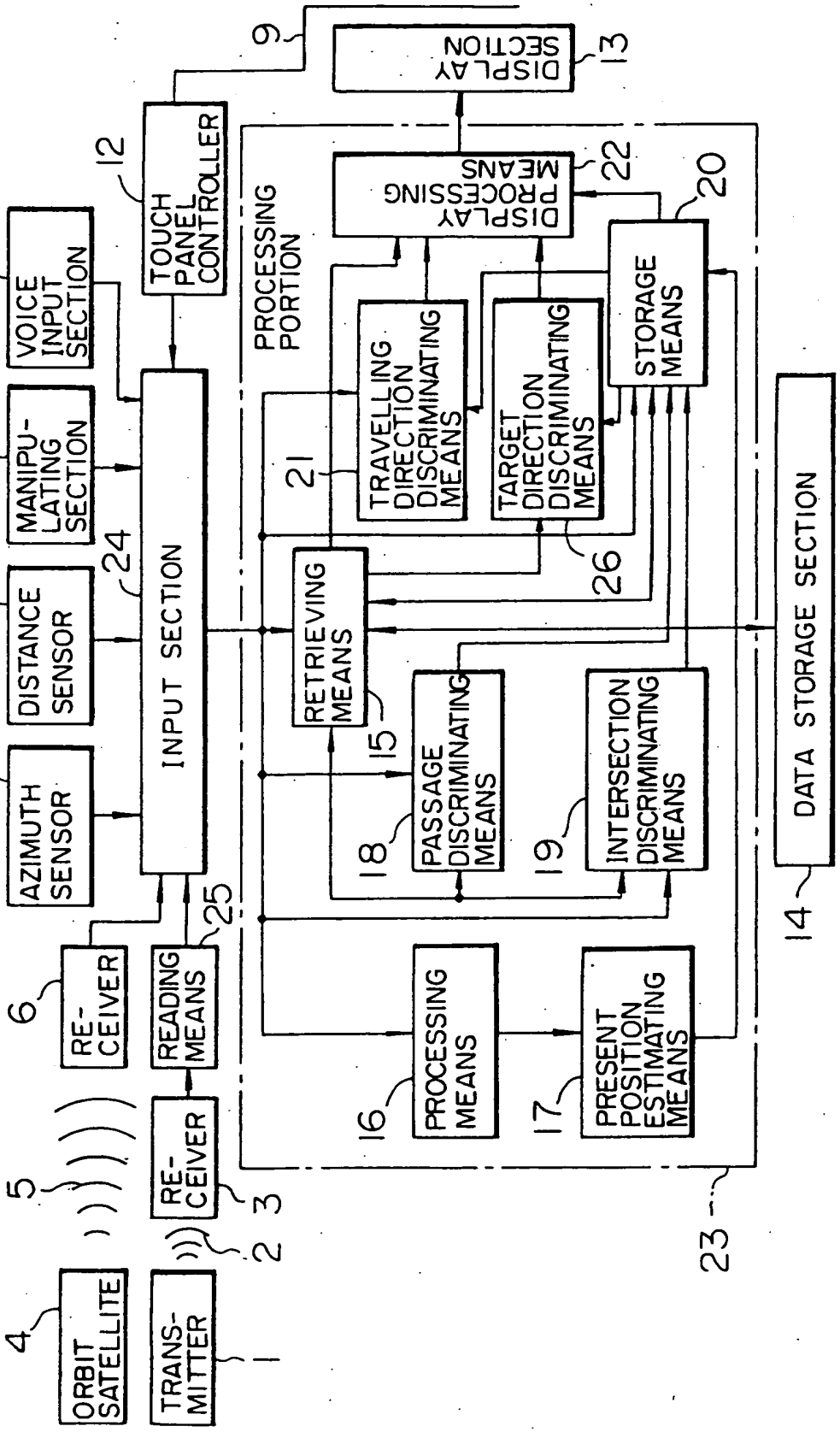
61. A navigation method according to claim 60, comprising the steps of storing data about the shape and the position of a passage at which the target confronts and data about the shape and the position of a passage which constitutes a course through which the moving object is able to properly and correctly reach from a main passage adjacent to the target in said storage section, retrieving data of the position of said target and data about the shape and the position of said passage at which said target confronts, retrieving data about the shape and the position said passage constituting said course, and indicating the shape and the position of said passage constituting said course on said display section together with the position of said target and the shape and the position of said passage at which said target confronts.

62. A navigation method according to claim 34, in a case where means for inputting and setting a target is comprised, when setting said target, comprising the steps of retrieving a target direction, the start point of which is made to be a present position or an equivalent position in place of the present position, and indicating said target direction by an arrow or the like on said display section together with said travelling line.

63. A navigation method according to claim 34, in a case where means for inputting and setting a target is comprised, when setting said target, comprising the steps of retrieving a target direction while making an arbitrary point of an area on said display section to be a start point, and indicating said target direction by an arrow or the like on said display section together with said travelling line.

64. A navigation method according to claim 34, when as to said passage through which said moving object is moving at this very moment novel information different from said information which has been supplied is supplied, and data is retrieved by said information and said travelling line is indicated on the basis of said data, comprising the step of indicating both said travelling lines respectively by said previous information and said novel information in a manner that said two lines are indicated by different kinds of lines or different colors.

FIG. 1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TOUCH PANEL CONTROLLER
INPUT SECTION
PROCESSING PORTION
DISPLAY SECTION
DISPLAY PROCESSING MEANS
STORAGE MEANS
TRAVELLING DIRECTION DISCRIMINATING MEANS
TARGET DIRECTION DISCRIMINATING MEANS
RETRIEVING MEANS
PASSAGE DISCRIMINATING MEANS
INTERSECTION DISCRIMINATING MEANS
PROCESSING MEANS
PRESENT POSITION ESTIMATING MEANS
DATA STORAGE SECTION
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FIG. 2

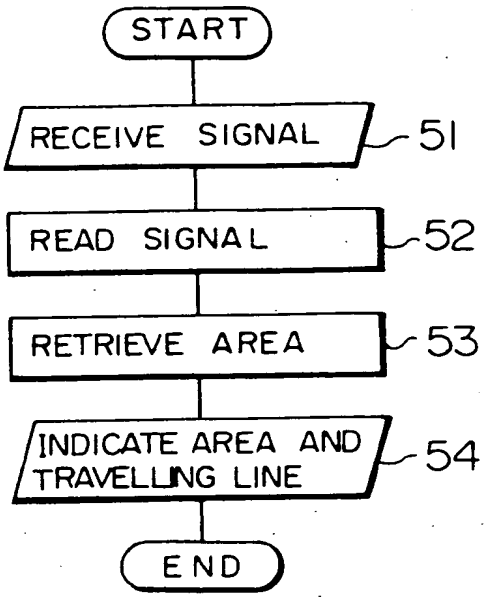


FIG. 3

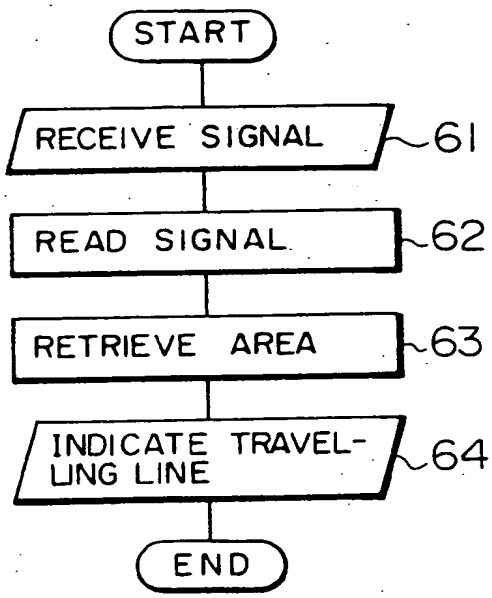


FIG. 4

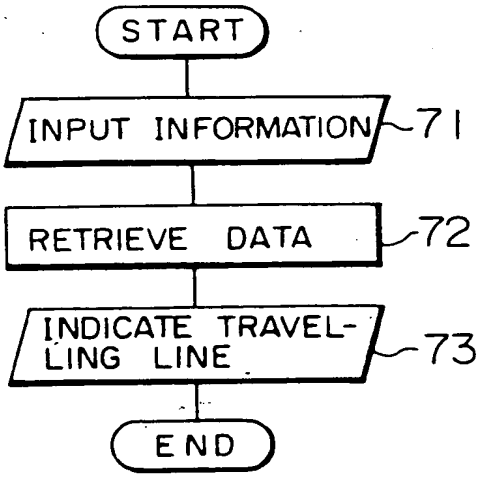


FIG. 5

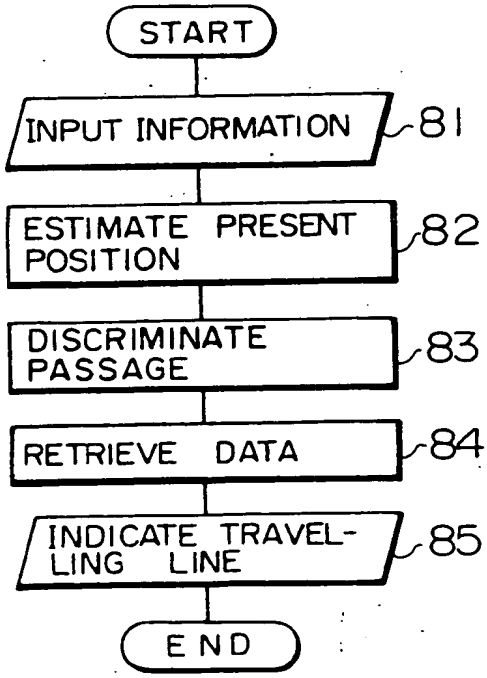


FIG. 6

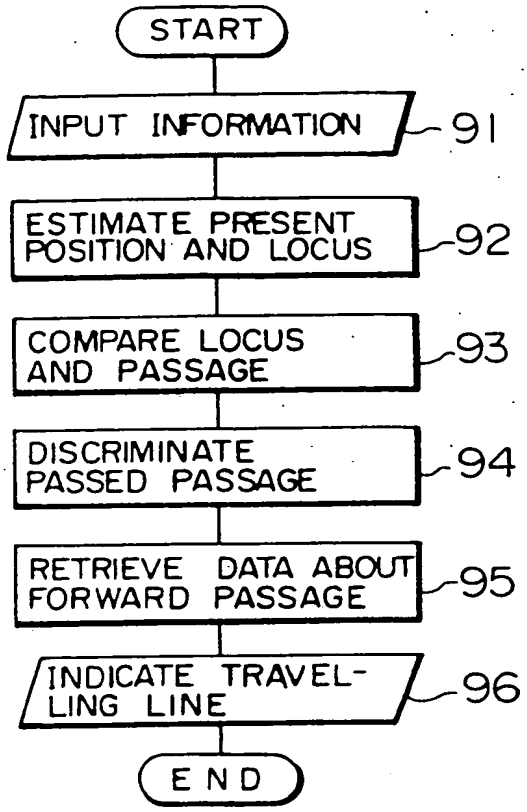


FIG. 7

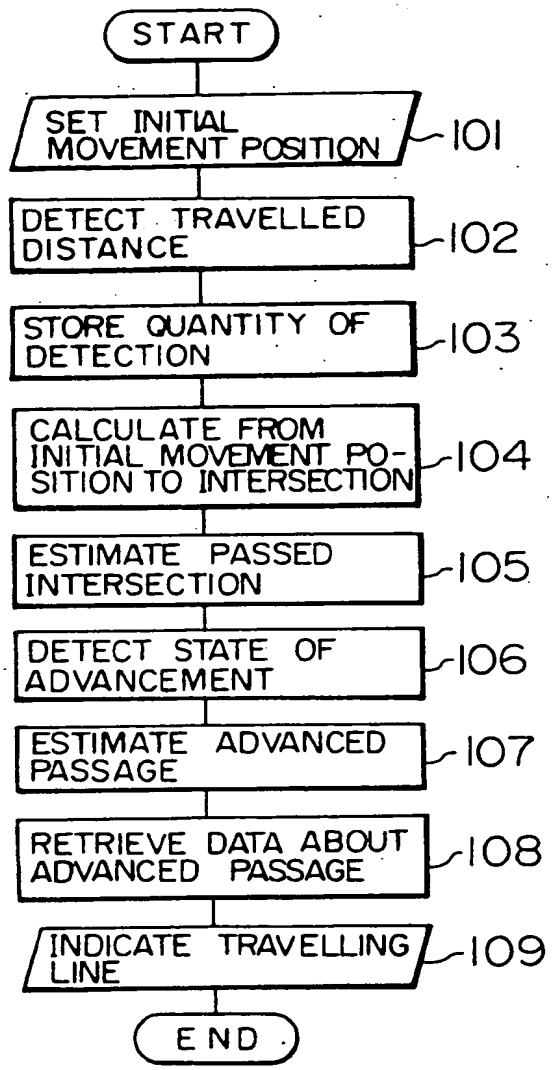


FIG. 8

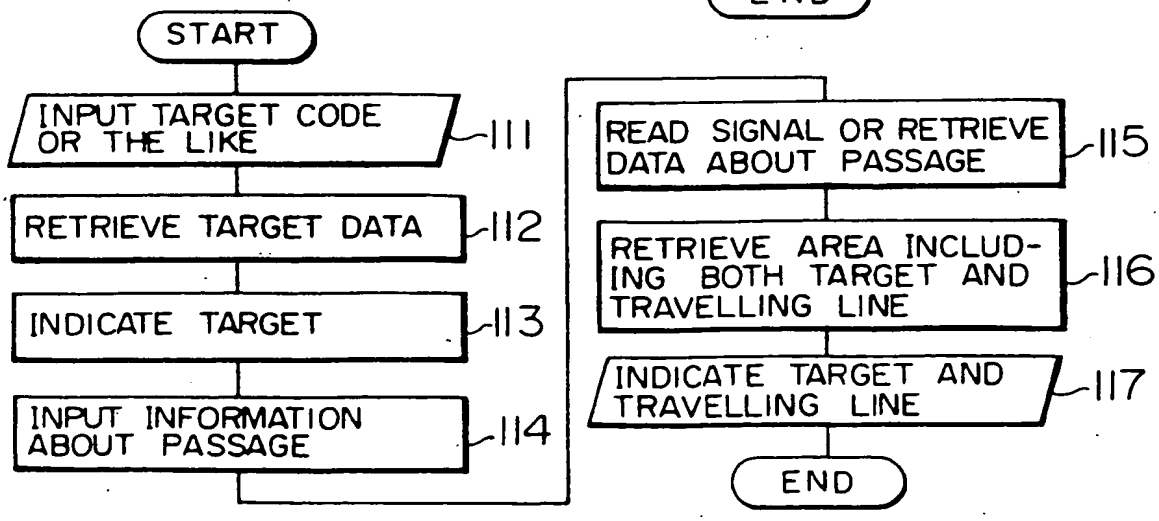


FIG. 9

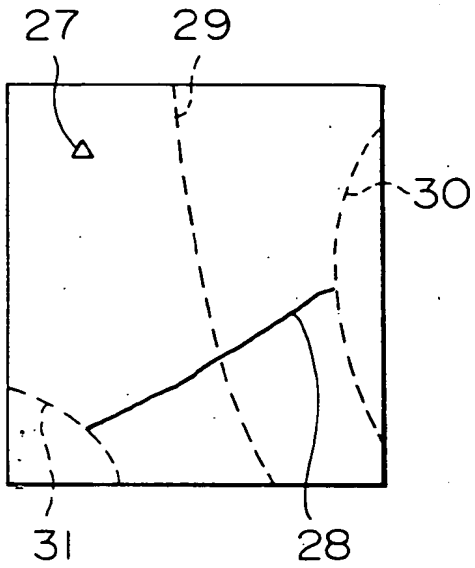


FIG. 10

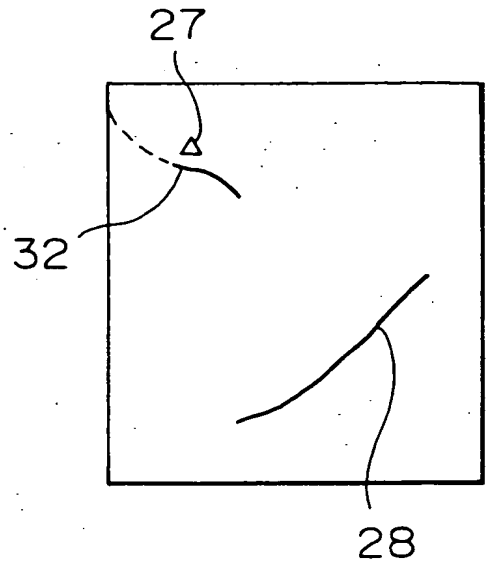
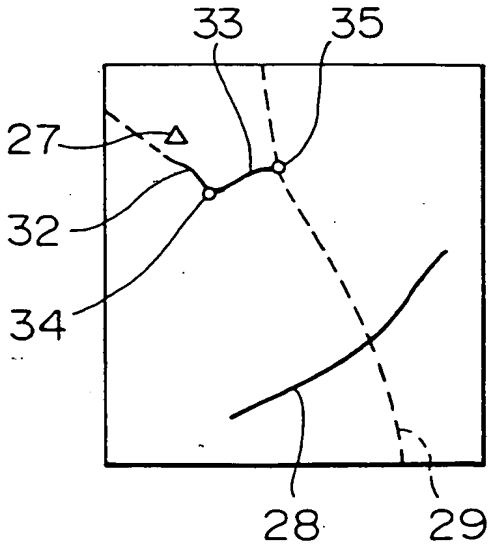


FIG. 11



INTERNATIONAL SEARCH REPORT

International Application No PCT/JP90/01064

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl^5 G01C21/00

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC	G01C21/00-21/24

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

Jitsuyo Shinan Koho 1941 - 1990
Kokai Jitsuyo Shinan Koho 1971 - 1990

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X	JP, A, 50-148788 (Toshihiro Tsumura), 28 November 1975 (28. 11. 75), (Family: none)	1-5, 19, 20, 34-38, 52, 53
X	JP, B2, 58-53282 (Casio Computer Co., Ltd.), 28 November 1983 (28. 11. 83), (Family: none)	1, 6, 7, 21, 34, 39, 40, 54
X	JP, A, 61-264210 (Hitachi, Ltd.), 22 November 1986 (22. 11. 86), (Family: none)	1, 8-11, 15, 22, 23, 29, 30, 33, 41-44, 48, 55, 56, 62-64
X	JP, B2, 57-25764 (The Boring Co.), 1 June 1982 (01. 06. 82), (Family: none)	1, 12, 13, 45, 46

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
November 9, 1990 (09. 11. 90)	November 26, 1990 (26. 11. 90)
International Searching Authority	**Signature of Authorized Officer**
Japanese Patent Office	

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

V. ☒ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE [1]

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers . because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim numbers . because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☒ Claim numbers (14, 16-18, 24-28, 31, 32, 47, 49-51, 57-61) because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING [2]

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.